CLAIMS

1. A method for operating an electric motor, which motor comprises

a stator (39);

an external rotor (40), which external rotor (40) comprises a sensor magnet (54) having a plurality of sensor poles (55);

at least one rotor position sensor (42, 44), connected to the stator; and

a rotor position evaluation arrangement (100);

which method comprises the following steps:

A) with the at least one rotor position sensor (100), at least one rotor position signal dependent on the rotational position of the sensor magnet (54) is generated;

B) the at least one rotor position signal is delivered to the rotor position evaluation arrangement (100);

C) the at least one rotor position signal is converted, in the rotor position evaluation arrangement (100), into at least one digital value having a resolution of at least two bits, with the result that the at least one rotor position signal can be converted into different digital values even at rotational positions within the angle range of one sensor pole.

2. The method according to claim 1,

wherein the at least one rotor position signal is generated as an analog rotor position signal.

3. The method according to claim 1 or 2,

wherein the at least one rotor position signal is converted in the rotor position evaluation arrangement (100) into at least one digital value having a resolution of at least four bits.

4. The method according to any of the preceding claims,

wherein the at least one rotor position signal is converted in the rotor position evaluation arrangement (100) into at least one digital value having a resolution of at least eight bits.

5. The method according to any of the preceding claims, which additionally comprises the following step:
A1) step A is performed continuously.

6. The method according to any of the preceding claims, which additionally comprises the following step:
B1) step B is performed continuously.

7. The method according to any of the preceding claims, which additionally comprises the following step:
C1) step C is repeated at intervals in time.

8. The method according to claim 8, which additionally comprises the following step:
C2) step C is repeated at fixed intervals in time.

9. The method according to either of claims 7 or 8, which additionally comprises the following step:
C3) the at least one digital value is converted into a value within a predetermined value range.

10. The method according to claim 9, which additionally comprises the following step:
C4) for the normalization of step C3, at least one correction value is ascertained and stored in a respective previous revolution of the external rotor (40).

11. The method according to claim 10, which additionally comprises the following step:
C5) in step C4, an average of the current correction value and at least one previous correction value is calculated.

12. The method according to any of the preceding claims, which additionally comprises the following step:

D) the rotational position of the external rotor (40) is calculated from the at least one digital value.

13. The method according to claim 12, which additionally comprises the following step:

D1) in step D, the number of periods that at least one of the rotor position signals has cycled through is ascertained by means of the at least one digital value.

14. The method according to claim 13, which additionally comprises the following step:

D2) in step D1, the period count is reset to a predetermined value after sensing of a predetermined number of periods.

15. The method according to claim 13 or 14, which additionally comprises the following step:

D3) the rotational position of the external rotor (40) is calculated by means of the ascertained number of periods and the at least one digital value.

16. The method according to any of claims 12 through 15 for an electric motor associated with whose sensor magnet are two rotor position sensors (42, 44), which additionally comprises the following step:

D4) in step D, the digitized values of both rotor position sensors are used to calculate the rotational position of the external rotor (40).

17. The method according to any of claims 12 through 16, which additionally comprises the following step:

E) the rotation speed of the external rotor is ascertained from the calculated rotational position of the external rotor at a first point in time and the calculated rotational position of the external rotor at a second point in time.

18. The method according to any of the preceding claims, which additionally comprises the following step:

F) the rotation direction of the external rotor (40) is ascertained from the change over time in the at least one digital value.

19. The method according to any of the preceding claims which additionally comprises the following step:

G) upon startup of the electric motor, the external rotor (40) is brought into a defined initial position.

20. The method according to claim 19, wherein upon startup, the external rotor (40) is brought into the defined initial position by an energization of the stator (39).

21. An electric motor that comprises

a stator (39);

an external rotor (40),

which external rotor (40) comprises a sensor magnet (54) having a plurality SP of sensor poles (55);

at least one rotor position sensor (42, 44) for generating a rotor position signal (140, 142);

a rotor position evaluation arrangement (100) for generating an absolute value for the rotor position,

which apparatus comprises an A/D converter (144) having a resolution of at least two bits,

the at least one rotor position sensor (42, 44) being connected to the A/D converter (144).

22. The electric motor according to claim 21,

wherein the at least one rotor position sensor (42, 44) is implemented as an analog rotor position sensor.

23. The electric motor according to claim 21 or 22,

wherein the rotor position evaluation arrangement (100) is implemented as an absolute value sensor (100) for the rotor position, which sensor can indicate the position of the rotor at any point in time by means of an evaluation of the rotor position signal.

24. The electric motor according to any of claims 21 through 23,

the A/D converter (144) having a resolution of at least four bits.

25. The electric motor according to any of claims 21 through 24,

the A/D converter (144) having a resolution of at least eight bits.

26. The electric motor according to any of claims 21 through 25,

having a microprocessor (100) that constitutes at least a part of the rotor position evaluation arrangement (100).

27. The electric motor according to any of claims 21 through 26,

wherein the at least one rotor position sensor (42, 44) is arranged on the radially inner side of the sensor magnet (54).

28. The electric motor according to any of claims 21 through 27,

which comprises two rotor position sensors (42, 44) that are arranged at a spacing of n * 180 el. + 90° el., where n = 0, 1, 2, 3, 4, ...

29. The electric motor according to any of claims 21 through 28,

the sensor magnet having a number SP of sensor poles greater than or equal to ten.

30. The electric motor according to any of claims 21 through 28, wherein the external rotor (40) comprises a sensor magnet (54) and a rotor magnet (50) interacting with the stator (39), which rotor magnet has a plurality RP of rotor poles such that RP < SP.

31. The electric motor according to claim 30, the rotor magnet (50) having a trapezoidal magnetization.

32. The electric motor according to claim 30 or 31, the external rotor (40) comprising an unmagnetized region (52) between the rotor magnet (50) and the sensor magnet (54).

33. The electric motor according to any of claims 30 through 32, wherein the expression governing the number SP of sensor poles is $SP = (2n - 1) * RP$, where $n = 1, 2, 3, 4, \ldots$.

34. The electric motor according to claim 33, where $n >= 2$.

35. The electric motor according to claim 33, where $n >= 3$.

36. The electric motor according to claim 33, where $n >= 4$.

37. The electric motor according to any of claims 30 through 36, the external rotor being implemented in such a way that at the angular locations at which the rotor magnet (50) exhibits a change in magnetic field direction, the sensor magnet (54) likewise exhibits a change in magnetic field direction.

38. The electric motor according to claim 37, the change in magnetic field direction for both the sensor magnet (54) and the rotor magnet (50) occurring in the same direction at those angular locations.

39. The electric motor according to any of claims 30 through 38, the rotor magnet (50) and sensor magnet (54) being implemented integrally.